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PALYNOLOGY AND MODE OF POLLINATION IN DIFFERENT SPECIES OF SOLANUM

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ABSTRACT

In the present study, palynology and mode of pollination prevalent in various selected species of Solanum were traced. Comparison was made between the cultivated S. melongena varieties Haritha and Surya and the wild variants of Solanum viz., S. viarum, S. incanum, and S. gilo. The shape of the pollen grain was uniformly round in all the types evaluated. Pollen grains were oblong and bi or trizonocolporate. Exine was with ornamentation in all the species. There was significant variation among the types of the length of pollen grains. Pollen viability lasted for only three days in all the genotypes evaluated. In S. incanum, S. gilo and S. melongena variety Haritha pollen fertility was at peak during the second day of flower opening and declined on the third day of a flower opening. In S. viarum and S. melongena variety Surya, pollen fertility declined during the second day of flower opening (90.08% and 87.95% respectively). However, on the third day of flower opening an increasing trend was noticed (97.33) and the fertility reached the peak on the third day of a flower opening. With the closing of the flower on the third day, evening the fertility was completely lost in all the species evaluated. None of the protected buds set fruits. It indicates the absence of self pollination. With unprotected buds, fruit set ranging from 60% in S. viarum to 100% in S. melongena type Surya was observed. This indicates that Solanum species are adapted to cross pollination. No fruit set observed in emasculated, but unprotected buds also. It may be because of the absence of sufficient pollinators. Cross pollination occurred in brinjal due to transfer of pollen by thrips, ants and bees.

KEYWORDS: Pollen Fertility, Viability, Bagging and Out Crossing

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INTRODUCTION

Evaluation of pollen viability is crucial in the process of hybridization. The viability of pollen grains in brinjal was found to be affected by many endogenous factors like nutritional status of the plant (Howlett, 1936), agricultural pesticides and other chemicals (Mac Daniels and Hildebrand, 1939; Dubey and Mall, 1972. Pal and Singh (1943) observed maximum pollen fertility on the 2nd day of flower opening in brinjal. Popova (1958) found that pollen grains remained viable up to 7-10 days in brinjal. Oyelana and Oguwenmo (2012) reported that the shape of pollen grains was round, oblong, triangular or rectangular depending on the species of *Solanum*. The largest pollen grains were observed in *S. gilo*.

Determination of the mode of pollination is an important step in carrying out distant hybridization. Kakizaki (1930) stated that the flowers of eggplant were self pollinated to certain extent. However, Schmidt (1935) observed cross pollination in brinjal. Magtang (1936) observed that the flowers of eggplant did not set fruit on bagging. Dascalov and Murtazov (1937) found that cross pollination occurred in brinjal to an extent of 30 to 40%. According to Agarwal (1980) as out crossing occurred to an extent of 0 to 48 %, eggplant can be treated as an often cross pollinated crop. Cross pollination occurred in brinjal due to transfer of pollen by thrips, ants and

bees (George, 1985; Lawande and Chavan, 1998). Abak *et al.* (1995), Stepowska (1996) and Dobromilska (1997) observed that bumble bees were helpful in increasing fruit set in eggplants. An out crossing to an extent of 3.7 % was observed in eggplants in China by Chen *et al.* (2000). Kowalska (2003a, 2003b, 2006) reported that flowers pollinated by insects showed an early fruit set and produced high quality fruits compared to self pollinated plants in brinjal.

Determination of the day in which maximum pollen fertility is observed is crucial in carrying out pollination. The mode of pollination prevalent in the species should be known. However the evidences relevant to the mode of pollination prevalent in various *Solanum* spouse are often contradictory. Keeping these facts in view, the present study was carried out to trace the fertility and viability of pollen grains as well as the mode of pollination prevalent in various sps of *Solanum*.

MATERIALS AND METHODS

Palynology

The variant forms of three wild species of *Solanum* maintained by NBPGR – RS, Vellanikkara, as well as two high yielding varieties of *S. melongena* (Haritha and Surya) from Kerala Agricultural University formed the material for the study.

The pollen grains were examined in detail as per the standard procedures suggested by Nair (1970). Size, shape and viability of pollen grains were examined. The size of the pollen was measured using phase contrast microscope. The fertility of pollen grain was estimated following acetocarmine staining technique (Moore and Webb, 1972). Pollen grains were obtained by squeezing the anthers with a sharp needle. They were then stained with one percent acetocarmine. The well stained pollen grains were considered to be fertile and the unstained ones as sterile. Observations were taken from five different fields of the prepared slides in each genotype. The fertility was computed and expressed as a percentage.

Pollination Biology

Three sets of ten fully mature flower buds each from each of the genotypes were used to find out the mode of pollination prevailing in the species variants. Only long styled flower buds were used for this study. First set of ten flower buds in each genotype was protected with butter paper cover starting from a day prior to flower opening till the completion of anthesis. Another set of buds from each genotype was emasculated, but kept unprotected. The third set, kept unprotected without emasculation was taken as the control. The extent of fruit set in protected buds, emasculated, but unprotected buds and unprotected buds were recorded and expressed as a percentage.

RESULTS

The morphological features of the pollen grains, including the size and shape of pollen grains were observed with a phase contrast microscope and the results are presented in Table 1.

The fertility of the pollen grains in different species was also examined. Repeated observations were taken on pollen fertility in each type under evaluation, consecutively for three days after dehiscence and the results are presented in Table 2.

Mode of pollination prevalent in the *Solanum* species was estimated by observing the fruit set in three different sets of mature flower buds *viz*., protected, unprotected and emasculated but unprotected buds. The long styled flowers alone were used for this study. The results are presented in Table 3.

DISCUSSIONS

The shape of the pollen grain was uniform in all the types evaluated. Pollen grains were oblong and bi or trizonocolporate. Exine was with ornamentation in all the species. Oyelana and Oguwenmo (2012) reported that the shape of pollen grain might be round, oblong, triangular or rectangular depending on the species of *Solanum*.

There was significant variation among the types of the length of pollen grains. It was the highest (0.06 µm) in *S. viarum* and the lowest in *S. incanum* which was on par with *S. gilo*. Pollen grains of *S. melongena* Haritha and Surya did not differ significantly in length. However, their pollen grains were longer than that of the two wild variants *S. incanum* and *S. gilo*.

S. viarum, S. incanum, S. gilo and *S. melongena* type, Surya were on par with respect to the width of pollen grains. The width of the pollen grain was the highest in *S. melongena* type Surya. There was a significant difference among the entries with respect to the perimeter of the pollen grains. However, Oyelana and Oguwenmo (2012) observed that *S. gilo* was having the largest pollen grains.

In *S. incanum*, *S. gilo and S. melongena* variety Haritha pollen fertility was at peak during the second day of flower opening and declined on the third day of a flower opening. Pal and Singh (1943) also observed maximum pollen fertility during the second day of flower opening in *S. melongena* (brinjal). In *S. viarum* and *S. melongena* variety Surya, pollen fertility declined during the second day of flower opening (90.08% and 87.95% respectively). However, on the third day of flower opening an increasing trend was noticed (97.33) and the fertility reached the peak on the third day of a flower opening. With the closing of the flower on the third day, evening the fertility was completely lost in all the species evaluated. Hence, it can be concluded that pollen viability lasted for only three days in all the genotypes evaluated. In contrary to this, Popova (1958) found that pollen grains remained viable up to 7-10 days in *S. melongena* (brinjal).

None of the protected buds set fruits. It indicates the absence of self pollination. Magtang (1936) also observed that the flowers of eggplant did not set fruit on bagging. However, according to Kakizaki (1930) flowers of eggplant were self pollinated to certain extent.

No fruit set observed in emasculated, but unprotected buds also. It may be because of the absence of sufficient pollinators. Cross pollination occurred in brinjal due to transfer of pollen by thrips, ants and bees (George, 1985; Lawande and Chavan, 1998). Abak *et al*. (1995), Stepowska (1996) and Dobromilska (1997) observed that bumble bees were helpful in increasing fruit set in eggplants.

With unprotected buds, fruit set ranging from 60% in *S. viarum* to 100% in *S. melongena* type Surya was observed (Table 14). This indicates that *Solanum* species are adapted to cross pollination.

Cross pollination is reported to occur in brinjal due to the transfer of pollen by thrips, ants and bees (George, 1985; Lavande and Chavan, 1998). Popova (1958) reported that fruit set was the maximum in brinjal when stigma received pollen from different plants. Out crossing to an extent of 6.7% was reported by Sambandam (1964) in the flowers of eggplant. According to Agarwal (1980), out crossing occurred to an extent of 0 to 48 per cent in eggplant and hence, can be treated as an often cross pollinated crop.

CONCLUSIONS

The pollen grains belonging to all the species of *Solanum* considered for the study remained viable for three days.

In *S. incanum*, *S. gilo and S. melongena* variety Haritha pollen fertility was at peak during the second day of flower opening and declined on the third day of flower opening. In *S. viarum* and *S. melongena* variety Surya, pollen fertility declined during the second day of flower opening (90.08% and 87.95% respectively). However, on the third day of flower opening an increasing trend was noticed (97.33) and the fertility reached the peak on the third day of flower opening. With the closing of the flower on the third day evening the fertility was completely lost in all the species evaluated. All the genotypes under the study exhibited cross pollination.

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APPENDICES

Table 1: Pollen Morphology in Different Species of Solanum

Types	Shape	Size of pollen		
		Length (µm)	Width (µm)	Perimeter (µm)
S. viarum	Oblong	0.06	0.03	0.14
S. gilo	Oblong	0.02	0.04	0.13
S. incanum	Oblong	0.01	0.03	0.11
S. indicum	Did not flower			
S. melongena				
Haritha	Oblong	0.05	0.03	0.14
Surya	Oblong	0.04	0.05	0.12
CD (0.05)	-	0.01	0.01	0.01
CV (%)	-	21.1	14.9	4.92

Table 2: Pollen Fertility in Different Species of Solanum

Types	Pollen fertility %		
	On the Day of Flower Opening	2nd Day of Flower Opening	3rd Day of Flower Opening
S. viarum	94.04	90.08	97.33
S. gilo	75.50	87.50	44.61
S. incanum	83.35	92.42	69.15
S. indicum	Did not flower		
S. melongena			
Haritha	87.70	91.90	85.30
Surya	91.60	87.95	97.33

Table 3: Fruit Set in Protected and Unprotected Buds in Different Species of Solanum

Types	Fruit set (%)		
	Protected	Emasculated but Unprotected	Unprotected
S. viarum	0	0	60

Table 3: Contd.,			
S. gilo	0	0	0
S. incanum	0	0	80
S. indicum	Did not flower		
S. melongena			
Haritha	0	0	80
Surya	0	0	100